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QUERIES AND INFORMATION.

RUSSIAN SCIENCE NOTES.

By Professor G. B. HALSTED, University of Texas, Austin, Texas.

The Jubilee-book issued by the University Kasan in commemoration of the Lobachevsky Centenary has already reached a very great circulation. His compatriots are pushing the non-Euclidean geometry.

N. P. Sokolov has just issued at Kiev (University Press) a pamplet of 32 pages (large 8vo.) entitled "The significance of the researches of N. I. Lobachevsky in geometry."

Volume IV of the second series of the Bulletin of the physico-mathematical society of Kasan, pp. 18-41, contains an interesting contribution by W. Sichstel on the fundamental theorems of spherical geometry.

Two books on America have lately been published in Russian. One is by Witkowsky, a scientist sent by the Russian government to study geodetic work in the United States. The other is published by a Russian, now resident in Los Angeles, who has been more than ten years in America, and has here amassed a fortune. He is a fervid republican, and writes under the *nom-de-plume* Tverski.

The well-known and justly admired writer Korolenko, ranked by the Russians second only to Tolstoi of living authors, was, during 1893, in America, and is about to issue his impressions of travel. This book, because of the high reputation of the author, is awaited with keen interest.

ARE LOBATSCHEWSKY'S PRINCIPLES APPLICABLE TO MECHANICS?

By WARREN HOLDEN, Professor of Mathematics, Pennsylvania Girard College, Philadelphia.

1. Is it expected that, when Lobatschewsky's new geometry is generally accepted, it will so permeate the old geometry as to modify its practical applications? Will the problems of engineering and construction have to be reconsidered?

Take a single example.

The builder of a railroad is very careful to keep the two rails of the track "everywhere equidistant." Unless they were parallel in the Euclidian sense disaster to a passing train would reveal the fact. Would Lobatschewsky's parallels, which always approach each other, answer for railroads?

2. Upon the surface of a sphere take a triangle with a given length of sides. The greater the diameter of the sphere the nearer the surface enclosed by the triangle approximates a plane, and simultaneously the nearer the sum of the angles of the triangle approaches two right angles. In passing from

surfaces, on which the angle sum is greater than two right angles, to surfaces, if any such there be, on which the angle sum is less than two right angles, we must come to a surface on which said sum is equal to two right angles. If this surface be not the Euclidian plane, what is it?

PROFESSOR SCHEFFER'S QUERY.

QUERY: Can any one furnish a reason for the peculiar name of the "devil's curve," or for the name which Professor Matz employs? J.F.W.S.

ANSWER.

"The Devil on Two Sticks" is best described as *a horizontal top*. According to the *Century Dictionary*, these toys are turned out of hard wood. Inclose the figure 8 with braces, { 8 }; take a strong cord about four feet in length, and fasten one end of this cord in the concave part of each cusp of the braces. These braces are *distorted* branches of "la curbe du diable;" and they represent the *sticks*, by means of which the cord is rapidly manipulated in spinning the devil. Loop the cord around the waist of the devil; then bring the two sticks into a vertical plane; and acquire skill in balancing the devil and getting him into a motion of rotation about a vertical axis, by means of the friction of the cord. Unless you *spin* the devil in a *lively* manner, he will fall off the chord and hurt your toes in revenge! As to the genesis and history of this curve and its branches, all appears to be obscure; Cramer may have given the name "la courbe du diable," since this curve clearly characterizes the *outline* and *symmetry* of the toy—"The Devil on Two Sticks." So far as is known to Professor William Woolsey Johnson and the writer, Cramer is the first to use the French name of this curve. Undoubtedly *Routh's Rigid Dynamics* and other standard works on *Rotation*—not omitting Professor Ziwet's excellent *Treatise on Theoretical Mechanics*, would furnish very desirable theoretical knowledge in mathematically spinning "The Devil on Two Sticks."—F. P. MATZ.

ARTHUR CAYLEY.

By Professor G. B. HALSTED, University of Texas, Austin, Texas.

How Professor Cayley touched every thing mathematical, and touched nothing which he did not adorn, may be illustrated by the following unpublished letters, which were the first expression of discoveries that have since taken their permanent place in our best text-books.

They are both the outcome of the sudden and fruitful interest in *linkage*, dating from Sylvester's interview with Tchebychev, when, leaving behind him the diagram of the now celebrated Peaucellier's Cell, the illustrious Russian gave in parting the characteristic advice: "Take to Kinematics, it will repay you; it is more fecund than geometry; it adds a fourth dimension to space."

I will transcribe the letters exactly, not only because the recent death of Tchebychev, followed in less than two months by that of Cayley, gives them now a special pertinence, but because it is of interest to compare one with what is given on "tram motion" in Kempe's "How to Draw a Straight Line," and the other with its reproduction by no less a master than Clifford on pages 149, 150 of his Dynamic, whence I add figure 2.

"Roberts' theorem of 3 bar motion takes the following elegant form: Take a triangle ABC & a point O and thro' O draw lines ‖ to the sides as in the figure—the 3 shaded △'s are of course similar to ABC.

Now imagine a linkage composed of the shaded △'s and the bars AA_2, AA_3, BB_3, BB_1, CC_1, CC_2 pivotted together at A, B, C, A_2, A_3, B_3, B_1, C_2, C_1, O: then however the figure is moved, [of cource A_3, B_3 do not continue in the line AB, &c.], the triangle ABC *will remain similar to the shaded triangles*: and if in any position of the figure we fix the points A, B, C, then the point O will be moveable in a curve, viz. we have the *same* curve described by O considered as the vertex of OA_3B_3, where the two radii are AA_3, BB_3—by O considered as the vertex of OA_2C_2 &c.—and by O considered as the vertex of OB_1C_1, &c. Cambridge 22nd, Feby. 1876.

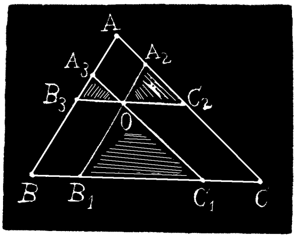

Fig. 1.

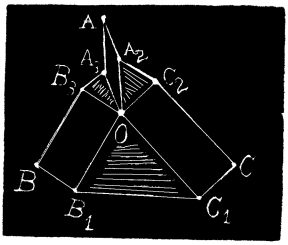

Fig. 2.

The porism is *very* pretty: it was new to me, tho' I think it ought not to have been so.

Look at the theorem thus. Imagine a plane, 2 points thereof A, C moving in fixed lines $O\alpha$, $O\gamma$.

Describe the circle OAC, which consider as a circle fixed in the plane & moveable with it. Then the theorem is that any point B of this circle moves in a line $O\beta$ thro' O.

In particular B may be the opposite extremety of the diameter thro' A: and we have then the points A, B moving on the lines $O\alpha$, $O\beta$ at right angles to each other. Viz. the general case of a plane moving two points thereof on two fixed lines is reduced to this well-known particular case. And the theorem comes to this, that dividing the rod AB at pleasure into two parts AM, MB, and drawing MC at rt. angles and a mean proportional, the locus of C is a right line thro' O, which is of course easily proved."

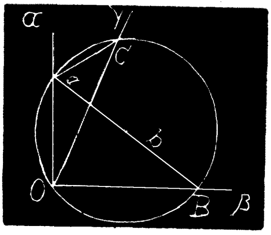

Fig. 3.

Yours very sincerely, A. Cayley.

Cambridge, 5th May.